

Effects of Low Intensity Laser Irradiation During Healing of Skin Lesions in the Rat

Ethne L. Nussbaum, PhD,^{1} Tony Mazzulli, MD, FRCPC,² Kenneth P.H. Pritzker, MD, FRCPC,³ Facundo Las Heras, MD,³ Fang Jing, MSc (Statistics),⁴ and Lothar Lilje, PhD⁵*

¹Department of Physical Therapy, Mount Sinai Hospital, University of Toronto, Toronto, ON, Canada M5G 1X5

²Department of Microbiology, Mount Sinai Hospital, University of Toronto, Toronto, ON, Canada M5G 1X5

³Department of Laboratory Medicine and Pathobiology, Mount Sinai Hospital, University of Toronto, Toronto, ON, Canada M5G 1X5

⁴JSQ Consulting, Mississauga, ON, Canada L5N 3K5

⁵Department of Medical Biophysics, University of Toronto, Toronto, ON M5G 2M9 Canada

Lasers in Surgery and Medicine 41:372–381 (2009)

Objective: To determine whether laser light can improve healing of skin wounds by killing wound bacteria while simultaneously accelerating host tissue activity.

Materials and Methods: Wounds on the rat dorsum were irradiated or sham-irradiated three times weekly from days 1 to 19 using 635 or 808 nm diode lasers at 1 or 20 J/cm². Wound area and bacterial growth were evaluated three times weekly. Histological analysis was performed on days 8 and 19. Immunohistochemical analysis was performed on day 19.

Results: Wounds that were irradiated using 635 nm light at 1 J/cm² healed similarly to controls. Wounds that were irradiated using 808 nm (1 and 20 J/cm², P<0.05) and 635 nm light (20 J/cm², P<0.05) were worse in wound maximum area at day 3 compared with controls. Further, 635 nm light at 20 J/cm² delayed wound closure at day 19 (ASL=0.0127). Bacterial colonization of wounds was altered using 635 nm (20 J/cm², P<0.0001) and 808 nm light (1 J/cm², P<0.0001; 20 J/cm², P=0.02). In particular, the presence of normal skin flora decreased (P<0.0001–0.0002) and, when using 808 nm light, the presence of *S. aureus* increased (P=0.0001). There was histological evidence of advanced repair using 635 nm at 1 J/cm² at day 8 (ASL<0.04). In contrast, markers of acute repair were increased and of late repair were decreased at day 19 using 635 nm at 20 J/cm² (ASL<0.04).

Conclusions: This study demonstrates that while clearing wounds of certain bacteria is feasible it does not necessarily translate into a healing advantage. When normal flora are disturbed, environmental organisms more readily colonize the wound surface. It is not clear when using 808 nm light whether the loss of normal flora in the wound alone is responsible for the proliferation of *S. aureus* or whether the light adds to the effect by stimulating *S. aureus* growth.